Industrial Technologies Program
Saving Energy at Data Centers

Taming an Intense and Growing Appetite for Electricity

Data centers provide mission-critical computing functions essential to the daily operation of top U.S. economic, scientific, and technological organizations. These data centers consume large amounts of energy to run and maintain their computer systems, servers, and associated high-performance components. To protect these systems and their vital functions, however, data centers also employ energy-intensive HVAC systems, fire suppression systems, redundant/backup power supplies, redundant internet connections, and high-security systems. In 2005, U.S. data centers used approximately 45 billion kWh (about 154 trillion Btu in end use), accounting for about 1.2% of all U.S. electricity consumption (Koomey 2007, Stanford University).

To support growing demand for processing power throughout the economy, individual data centers are increasingly using more compact and energy-intensive servers even as the total number and size of data centers continues to increase. This growth in electricity demand by individual data centers and the rapidly increasing number of data centers nationwide represent a significant increase in electricity demand. Rising electricity demands pose a serious threat to the already strained U.S. electric grid and to data center reliability. According to a recent survey, data centers average at least one serious outage per year.

The Opportunity

A coordinated program of focused R&D and operating practice improvements in data centers could produce large energy savings, reduce the load on the electric grid, and help the nation by increasing the reliability of critical computer operations.

Challenges

- Data center owners necessarily focus on reliability, maintaining daily operations, and managing rapid growth.
- Energy-saving techniques must be updated continuously because computer technology evolves rapidly; new server product requirements change faster than the technologies required to power and cool them.
- Tools for modeling energy management and heat transfer in data centers are limited by complexity, technical constraints, and cost.

Benefits

- Constrain increased electricity demand and associated carbon emissions
- Protect data and computing functions vital to our economy
- Reduce risk of power outages and increase regional electricity reliability
- Postpone need to build new electricity generation capacity
- Support replication of energy-efficient practices across the sector

DOE Resources Can Cut Energy Demand of Data Centers

DOE can play a key role in moderating data center electricity demand by working with new and existing centers to deploy energy management best practices and conduct supporting targeted research and development. The DOE strategy will focus on the following:

Building upon the success of Save Energy Now: DOE's highly successful Save Energy Now program and associated Energy Savings Assessment process provide a useful framework for working with data center owners and operators to benchmark energy use and identify opportunities for reducing energy demand by 10% to 20% through the adoption of energy-efficient practices. Activities include:

- Performing energy savings assessments to discover near-term measures with short payback periods to reduce electricity demand.
- Training data center designers in the latest energy management best practices and tools. In partnership with industry, DOE can also develop and deploy the curriculum and process for certifying Data Center Specialists with the expertise to assist data center operators in improving energy efficiency.
- Operating as a clearinghouse to broadly disseminate information on identified energy saving opportunities and best practices for data centers.
- Developing new software tools to profile Data Center energy use and specifically analyze the energy-efficiency needs of data centers. These tools would help data center operators uncover savings opportunities within their facilities.

Forging technology development partnerships: DOE will work with Data Center equipment suppliers and end users and the National Laboratories to explore joint DOE-industry R&D partnership opportunities.

For additional information, please contact:

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A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable